decade. Snow occurred on the 5th at Happy and Hartley. On the 24th a severe tornado struck Lytle, doing considerable damage. Hailstones became chunks of ice and fell with a force that broke through roofs of houses, imbedded themselves in trees, killed animals, and knocked men senseless to the ground. The tornado spent its force in about fifteen minutes.

Utah.—The mean temperature for the Territory was 49.2°. The highest daily, 94°, was reported from St. George on the 20th, and the lowest, 5°, from Loa, on the 5th. The average total precipitation was 0.58 of an inch, which fell principally on the last two days of the month. The greatest amount, 5.20 inches, was recorded at Levan, and the least, trace, at Cisco, Giles, and Emery. Thunderstorms were reported on the 10th, 27th, 28th, and 29th, and hail on the 14th, 28th, and 29th.

Vermont.—(See *New England.*)

Virginia.—The average monthly mean temperature for April, 1895, was 54.4°. The maximum daily was 95°, and occurred at Bon Air on the 25th, and the minimum was 22° at Grahams Forge on the 4th. The total amount of precipitation, 4.91 inches, averaged above the normal for the State. The greatest amount, 9.61 inches, occurred at Callaville, and the least, 1.16 inches, at Abingdon. Killing frosts were reported on the 3d, 4th, 5th, 9th, 10th, 11th, 12th, 15th, 16th, 17th, 18th, and 19th, but generally little or no damage resulted from them because of backward state of vegetation.

Washington.—April, 1895, was a trifle warmer than usual, the mean temperature for the State being 1.2° above the average. The precipitation was slightly below the average and was unevenly distributed, the eastern portion receiving fully one-half less than the average, while there was an abundance in the western portion. The total precipitation, 3.36 inches, shows a departure from the average of —0.41 of an inch. A phenomenal thunderstorm visited many localities in the western part of the State on the 9th, accompanied by hail and violent wind. Considerable timber was blown down. The eastern section was visited on the 1st by a violent duststorm, the severest ever known there, which unroofed some buildings, broke windows, carried away fences, etc.

West Virginia.—The mean temperature for the month, 52.6°, was about 1½° below the normal, and the precipitation, 2.93 inches, was well distributed and very near the normal. Many frosts occurred and snow fell to a depth of 2 to 3 inches at several points.

Wisconsin.—The average temperature for the month, 47.5°, was 3.4° above the normal for April, and the precipitation, 1.29 inch, was 2.11 inches below the normal. Most of the precipitation occurred between the 6th and 13th, except in the extreme northern portion, where considerable fell near the close of the month, but in other portions very little fell during the last fifteen days.

Wyoming.—The mean temperature for the month was 46°, which was several degrees above the average for April. The precipitation, 2.36 inches, was about one-third greater than the average. The greatest amount, 7.25 inches, being reported from Fort Washakie, and the least, 0.61 of an inch, from Fort Yellowstone.

NOTES BY THE EDITOR.

OBSERVATIONS AT HONOLULU, HAWAIIAN ISLANDS.

Meteorological observations at Honolulu, Republic of Hawaii, by Curtis J. Lyons, Meteorologist to the Government Survey.

Pressure is corrected for temperature and reduced to sea level, but the gravity correction, —0.06, is still to be applied.

The absolute humidity is expressed in grains of water, per cubic foot, and is the average of four observations daily.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 10.

The rainfall for twenty-four hours is given as measured at 6 a. m. on the respective dates.

April, 1895.	Pressure at sea level.			Temperature.					Humidity.			Wind.		Cloudiness.	Rain measured at 6 a. m.
	9 a. m.	3 p. m.	9 p. m.	6 a. m.	2 p. m.	9 p. m.	Maximum.	Minimum.	Relative. 9 a. m.	Relative. 9 p. m.	Absolute.	Direction.	Force.		
	Ins.	*Ins.*	*Ins.*	°	°	°	°	°	%	%					*Ins.*
1..	30.20	30.11	30.18	69	76	71	78	69	65	69	5.8	nne.	4	4-2	.00
2..	30.19	30.08	30.14	70	75	71	78	69	65	68	5.7	ene.	5	4	.00
3..	30.12	30.05	30.11	69	75	70	76	68	68	75	5.8	ne.	5	4	.01
4..	30.10	30.02	30.10	68	77	71	80	65	70	72	6.2	se,ne.	0-3	6-1	.01
5..	30.12	30.06	30.14	70	77	71	79	69	69	68	5.8	nne.	4	2	.00
6..	30.16	30.07	30.14	70	76	71	78	69	64	72	6.1	ne.	5	3	.03
7..	30.17	30.06	30.17	70	74	70	75	69	69	75	6.1	ne.	5	8-5	.05
8..	30.17	30.08	30.20	69	75	70	75	67	68	70	5.8	ene.	5	5	.09
9..	30.20	30.13	30.18	69	76	71	78	68	66	75	6.0	ene.	5	3	.02
10..	30.20	30.09	30.16	70	75	70	78	70	69	76	6.2	ne.	4	3	.00
11..	30.18	30.12	30.20	68	76	70	78	67	65	72	5.9	ne.	4	2	.08
12..	30.26	30.19	30.26	68	74	68	76	66	60	71	5.0	nne.	3	4-1	.00
13..	30.30	30.22	30.26	66	68	69	71	65	87	68	6.0	nne.	4	6	.04
14..	30.26	30.15	30.20	69	74	68	75	68	61	73	5.4	ne.	4	4	.14
15..	30.16	30.09	30.17	68	74	70	76	67	65	70	5.6	nne.	5	5	.00
16..	30.21	30.14	30.20	66	74	69	75	66	75	85	6.3	nne.	4	8	.37
17..	30.21	30.14	30.21	70	77	73	79	68	85	78	7.1	nne.	4	7	.56
18..	30.20	30.12	30.18	71	77	72	78	71	77	77	6.8	ne.	4	8	.18
19..	30.17	30.10	30.17	70	77	72	79	70	70	75	6.6	ene.	3	5	.21
20..	30.17	30.08	30.14	65	78	71	80	65	65	72	6.2	nne.	3	2	.00
21..	30.15	30.06	30.14	63	77	70	80	61	64	72	5.9	ne.	2	2	.00
22..	30.11	30.04	30.13	61	77	70	80	60	60	68	5.7	nne.	3-0	2	.00
23..	30.11	30.01	30.09	61	77	71	80	61	66	69	5.6	nne.	0-4	3	.00
24..	30.09	30.02	30.12	62	79	71	82	61	66	72	6.1	se-ne.	2	2	.00
25..	30.11	30.05	30.14	67	81	74	82	65	64	66	6.3	e.	3	2-5	.00
26..	30.13	30.05	30.13	70	79	70	82	69	61	77	6.0	nne.	3	1	.00
27..	30.13	30.05	30.11	68	81	72	82	65	62	65	6.2	nne.	2	3-1	.00
28..	30.12	30.07	30.13	68	78	73	81	67	70	70	6.6	sw.	1	2-10	.06
29..	30.16	30.08	30.17	73	81	73	83	67	70	72	6.7	ne.	2	5	.00
30..	30.21	30.12	30.23	73	81	74	82	71	63	70	6.4	ne.	4	3	.02
	30.169	30.088	30.163	68.0	76.5	70.9	78.5	66.8	67.6	72.1	6.1	....	......	......	1.77

Mean temperature: 6 + 2 + 9 ÷ 3 is 71.8; extreme temperatures, 83° and 60°.

On the island of Maui, 21.13 inches of rain fell in twenty-four hours on the 16th of the month; of this amount, 14.00 inches fell in four hours—from 12.30 to 4.30 p. m.

At Olaa, Hawaii, 13.65 inches fell in twenty-four hours. This precipitation was synchronous with heavy storms in Oklahoma and New England.

THE PASSAGE OF LOW AREAS OVER THE ROCKY MOUNTAINS.

On the 12th an area of high pressure was central in Kansas and the barometer had begun to fall in Arizona and British Columbia. On the 13th, p. m., pressure was lowest in Saskatchewan and a trough extended from this region to the Gulf of California; temperatures from 65° to 70° prevailed from New Mexico to Manitoba, with southeasterly winds, and temperatures from 50° to 60° prevailed over the plateau region and Pacific coast with easterly winds, except in Arizona, where 92° and 96° were reported During the 14th the trough of low pressure extended rapidly southward, and at 8 p. m. the isobar of 29.4 extended from Manitoba to Colorado. To the east and west of this trough pressures were higher, being highest, 30.1, over Lake Superior and San Francisco, respectively. On the east side southwest winds prevailed with rather high temperature, and on the west side, over the plateau regions, westerly winds with low temperatures. By the 15th, a. m., the northern portion of the area of low pressure had mostly filled up, but a small area of still lower pressure, 29.2, remained in central Kansas; this moved slowly eastward reaching eastern Kansas by 8 a. m. of the 15th and central Arkansas by 8 a. m. of the 16th.

The international maps of the Northern Hemisphere, which were published by the Weather Bureau for many years, demonstrate clearly that, in general, areas of high pressure and low pressure that first appear in the northwestern corner of the current daily weather map do not, properly speaking, originate either in Alberta or British Columbia, but are portions of a larger system of areas of high and low pressure that circulate between latitudes 40° and 70°. These highs and lows are so connected together that sometimes they may be treated as interacting cyclones and anticyclones, while at other times they are the interacting troughs and crests of waves, and again they are considered as minor episodes, like the whirlpools in a rapid stream of water. In this last case the cyclone is spoken of as a "driven eddy," although according to hydraulics, these eddies move as a whole, with only half the velocity of the average motion of the water within them. The international maps show, moreover, that when an area of low pressure or a cyclonic system of winds approaches the coast of British Columbia and Alaska it is generally moving from southwest toward the northeast, and that soon afterward an area of low pressure has developed south and east of the original center, namely in Alberta and Saskatchewan on the eastern slope of the Rocky Mountains. Several days are required for this process by which a storm dies away on the western slope while a new one develops on the eastern slope.

Generally speaking the well-defined whirl that characterized the original storm is entirely broken up in the lower atmosphere precisely as hurricanes are often broken up in attempting to pass over the Appalachians. During this stage the original circular low becomes, temporarily, an oval or a trough, or a V-shaped depression whose apex reaches as far south as Arizona and Mexico, while its broader end opens out toward the arctic circle. It now has, temporarily, the aspect and the structure of a wave, namely, a small wave superposed upon the general barometric depression of the arctic regions or upon some great area of low pressure, such as has been called a meiobar. Under these conditions air flows in from the nearest areas of high pressure, but the inflowing air under the action of the rotation of the earth necessarily deflects to the right, forming a still further depression and prolongation southward of the trough of low pressure. The amount of this depression is large and was explained by Ferrel in 1857, Colding in 1871, and Peslin in 1869, and still more elaborately by Guldberg and Mohn, 1872. (See the "Short Memoirs" in the Smithsonian report, 1877.) The southern end of this trough eventually, and almost invariably, shows the greatest contrast of winds, temperatures, and pressures, and very soon becomes the center of a well-defined cyclonic whirl while the northern end fills up. In this way the cyclone on the west side of the mountain range gives rise to a cyclone on the east side but farther south; the intermediate trough condition is the transition period.

The original cyclone was powerful because of its existence over the smooth ocean, and endured a long time because of its moisture and clouds. The new cyclone is far less powerful because of its existence in the interior of the dry continent, and it will die away if not supplied with moisture. As it passes eastward it encounters the Appalachian range, and generally goes through a precisely similar formation of ovals and troughs and a new center on the Atlantic coast; in this new location it is abundantly supplied with moisture on the east and dry air on the west, conditions eminently favorable to its further growth by the formation of cloud and rain.

In general, the irregularities of the earth's surface prevent a long continuance of stationary waves in the lower atmosphere, but favor the formation of permanent local areas of high and low pressure. If the ultimate cause of low and high pressures be waves due to gravity, these can exist only in the upper atmosphere; in some cases they may be as permanent as the so-called standing waves behind an obstacle in the river.

The weather chart of April 15 shows that the central low pressure in Kansas was accompanied by gales of from 30 to 50 miles per hour over a region 300 miles north and south by 200 east and west; no rain was reported south and west of Dodge City, and comparatively little at any point in that region; the high winds constituting the whirlwind were, therefore, not reinforced to any extent by any thermal disturbance due to clouds and rain; thus the wind came to rest and, therefore, the barometric depression filled up as the center moved slowly eastward and southward.

THE DUSTSTORMS OF APRIL 14 AND 15.

In connection with the above-mentioned area of low pressure, numerous duststorms were reported as follows: In Oklahoma, high winds and dust or sand storms at Healdton, Alva, Ponca City, and Pond Creek on the 14th and 15th. Equally high winds and a severe duststorm were experienced on the 5th over a large part of this same State.

In Minnesota, exceeding disagreeable duststorms were frequent, those of the 12th, 14th, and 21st were especially severe.

In South Dakota, severe sand or dust storms are recorded as having occurred on the 4th, 5th, 14th, 25th, and 27th over portions of the State; the most severe in general occurred on the 14th.

In North Dakota, furious and damaging duststorms at Ellendale, Gallatin, Lakota, and Steele on the 14th.

In Colorado, the voluntary observer, Mr. W. H. Powless, at Alma reports that on the evening of April 14 the sky had a peculiar brazen color; the snow that fell was tinged with pink. Those who were out in this snow reported their clothing covered with a deposit resembling mud. From newspapers we learn that on the 15th a terrible storm of sand and rain afflicted southern and western Kansas, Oklahoma, and the Panhandle of Texas. Egyptian darkness is said to have prevailed in western Oklahoma and the Panhandle. Showers of mud fell in Oklahoma, severe lightning occurred, and crops were badly damaged. The number of cattle killed is estimated at 5,000, and a score of these were smothered. Drifts of sand 6 feet deep were reported along the railroad tracks of western Kansas. A tornado occurred near Cherokee, Kans., in the evening.

GEOLOGICAL ORIGIN OF THE DUST.

The finest dust carried along by the winds over our western plains is generally composed largely of the minute shells of diatoms and foraminifera torn up from the chalk beds of the sedimentary Niobrara deposits that extend from central Iowa to the Rocky Mountains and from Texas to Manitoba. Further details as to this soil and its relation to our duststorms are given by Prof. Samuel Calvin in his address at the Brooklyn meeting of the American Association for the Advancement of Science, August, 1894.

DUSTSTORM IN WASHINGTON.

Duststorms are not confined to the eastern slope of the Rocky Mountains, as is evident from a paragraph in the April Review of the State Weather Service for Washington, where the director, Mr. George H. Salisbury, states that in the eastern section of the State there was a violent duststorm on April 1; it was the severest one ever known there and unroofed some buildings, broke windows, and carried away fences; fortunately the crops were not far enough advanced to be seriously damaged.

THE CHANGE FROM WINTER TO SUMMER.

In connection with the daily map of April 20, Mr. B. S. Pague, Local Forecast Official at Portland, Oreg., says:

> The summer type of weather conditions prevails this morning. An area of high barometric pressure which, on Tuesday evening, appeared off the northern California coast and which gradually moved northerly over western Oregon and western Washington, is central this morning over western British Columbia. This movement of the atmosphere is the first that has occurred since the fore part of last October, and it marks the commencement of summer, from a meteorological point of view. While there may, and most likely will, be a recurrence of the atmospheric movements peculiar to the winter season, yet, after the first pure summer movement, there is little possibility of any long-continued period of rainy weather. The gradual northward movement of the areas of high pressure along the coast culminating in the perfect type of summer conditions, such as prevail this morning, indicates that the storm areas are receding northward and cross the mountains far to the north, thus, indicating that a dry season is probable from now on. The rain that occurs from now until autumn will most likely be in the form of scattered showers rather than in the form of general rain.

THUNDER AND AIR PRESSURE.

Prof. H. A. Hazen states that on April 13, at 5.30 p. m., in Washington and in the open air—

> I noted a flash of lightning directly overhead. The thunder following this flash was at an interval of 4 or 5 seconds; and I noted at the same time with the thunder a very remarkable increase in the air pressure around my head. This increase in pressure was unmistakable, and was not due to the wind for the air was calm at the time. I have thought that this observation might be of some value, as I do not remember to have seen or heard of anything of the kind in the free air before.

THE WIND AND CHIMNEY DRAFT.

Sometimes, as we all know, the wind blows down the chimney, but, in general, when the chimney is properly placed and the wind is steady, a strong draft up the chimney is produced. Many experiments were published by Ewbank (Jour. Franklin Inst., 3, IV, 1842, p. 104) and subsequently by a committee of the American Academy at Boston, to ascertain the best form for the top of the chimney, and the general principles underlying the production of a strong draft. It was shown that when the wind blows against the side of the chimney, and is deflected both over the top and also to the right and left around the chimney, there is left a small region of relatively low pressure at the top surface. The smoke coming up from below is pushed into this region and then flows away with the wind. If the chimney did not stand as an obstacle in the wind there would be no region of low pressure and no draft. This same principle finds an application in many other cases; thus, when one blows against the end of a hollow tube, as in whistling over a key, the small region of low pressure allows the air within the tube to expand, and a rapid series of contractions and expansions make the shrill note of the whistle.

Again, in the so-called Hagemann anemometer, which is fully described in the treatise on Meteorological Apparatus, 1887, by the editor, the amount of the diminution of pressure at the upper end of a vertical tube exposed to the wind is measured, and hence the velocity of the wind is computed. When reading an aneroid barometer in the open air and strong wind, the observer will find that it reads lower if the face of the aneroid is held fronting the wind, because the small hole at the rear of the aneroid for communicating with the outer air admits only of the low pressure in the rear of the obstacle. Many observations were made by Montigny on the upper portion of the tower of the cathedral at Antwerp, which show that in strong winds pressure is especially deficient on the leeward side of the spire. Barometers established in special meteorological observatories, where high winds prevail, will always be found to be more or less affected by the so-called suction up the chimney, and the opening of doors and windows on the windward and leeward sides. Another instance of the effect of the wind is found in the case of the ordinary rain gauge; the gauges placed in windy spots catch less than those in quiet places, because the wind bounding over the top of the gauge forms a thin layer of swiftly-moving air, and the small drops that fall more slowly than the larger ones are carried off to one side of the gauge. Thus it is that elevated gauges catch less than those located nearer to the ground where the wind is less powerful.

EFFICIENCY OF WINDMILLS AND FARMERS' TOOLS.

Everyone knows that a sharp-edged tool, for cutting, must have its edge ground with a special reference to the object that is to be cut; thus, the edge that is best adapted to cutting cloth or paper is not appropriate to hard wood, and that which is good for the hard wood will not apply to iron or stone. About twenty years ago, a German or Austrian commission made an extensive practical study of the efficiency of the ordinary woodman's axe, and reported that of all the types and models submitted the so-called American axe was the best. The ordinary competition among manufacturers is generally sufficient to ensure that the farmer will purchase a fairly good implement when he goes into the open market with the advantage of a little experience and the advice of others. There are, however, many delicate and really important points to be considered in the construction of simple, to say nothing of complex, apparatus. The principle of survival of the fittest has, perhaps, led us to the best construction of axes, hammers, rakes, scythes, hoes, and plows; but there are many expensive and important pieces of apparatus, such as reapers, mowers, windmills, and pumps, to say nothing of portable steam engines, that are needed on large farms, or the centrifugal separators used in dairies, that fail to give satisfaction because of some inherent mechanical defect. The most efficient machine is that which produces the best result with the least possible waste of power. Thus, in a coal-burning locomotive 80 per cent of the power given out in combustion is lost so far as the work of pulling the train is concerned. In a small coal oil or gas engine the loss is rather less. In some forms of windmill scarcely 50 per cent of the effective wind pressure is utilized, and in a roughly constructed water wheel even less than this. In a hydraulic ram the efficiency is very high, although the force and work done are small. It is very desirable that there be some recognized authority to come between the manufacturer and the farmer; some one who shall "standardize" any piece of apparatus when desired, and certify as to the amount of power that is lost, or as to the efficiency of the machine when working under its best possible condition. This is practically done, for example, when the Government contracts for a new steamship, cannon, or gun.

The mechanical engineers are accustomed to determine very accurately the relation between the work done and the force expended, but no arrangement has yet been organized by means of which the farmer may obtain, for a small fee, accurate information as to the efficiency of the windmills, pumps, and other apparatus used by him. Is there not here a field of usefulness? Such tests are sometimes applied, but oftentimes imperfectly, to machines that are offered in competition for prizes at State fairs, but the results apply only to those specific samples and not to others that are ordinarily found in the market. The Government has established standards by which to test and sell such material as can be measured by the yard, bushel, gallon, or pound; it has even regulated the standards for the sale of illuminating gas, and, that newest of all powers, electricity; the time may come when it will regulate the sale of other powers, and standardize the machines for the conversion of force or the doing of work, prominent among which are the windmill and the pump. Thousands of farmers are wasting valuable power and, in modern civilization, power is money.

THE TIME OF BEGINNING OF RAIN.

In the May number of the Illinois Weather Crops, Mr. Charles E. Linney, as editor, calls attention to what seems to be an important device, by Mr. George Harris, voluntary observer at New Burnside, by means of which the time of beginning of rain is registered electrically. We hope that Mr. Harris will perfect his invention and publish it for the general benefit of the service.

DO THUNDERSTORMS ADVANCE AGAINST THE WIND?

The April bulletin of the Missouri State Weather Service publishes the following interesting items by E. D. Hicks, voluntary observer at Marceline (W. 93°, N. 39.6°), in the northeastern section of the State:

> There is a phenomenon connected with our rainstorms here that I have never seen in any State west of the Mississippi, and I have been in nearly all of them. It is this: Storm clouds will appear, we will say, in the west, and look extremely threatening, and one not acquainted with the country would declare we would have rain without fail, but it is not the case unless the wind is blowing directly against the storm clouds or squarely into the face of the approaching storm. If it is blowing quarterly in the least that rain cloud will surely pass around us. The wind must always blow squarely into the face of the approaching storm to insure us rain here in this high country. With the winter storms the case is reversed.

NOTE.—The very interesting generalization above recorded by Mr. Hicks is here quoted in hope that the voluntary observers in general will give us the benefit of their experience as to the relation between the direction of the wind and the path of the storm. This is a question peculiarly interesting to observers who have a free horizon. Records are much better than memory, and it is recommended that each make a note of the direction of the wind as soon as he sees evidences of the existence of a thunderstorm or thunderhead in the distant horizon. Of course the wind observed at the early morning observation might be used, but it is more appropriate to consider the wind that is more closely associated with the afternoon thunderstorms.

The bearing of the storm cloud and the direction of the wind should be observed to within at least one-sixteenth part of the whole circumference of the horizon, that is to say, adopting the ordinary notation: north, north-northeast, northeast, east-northeast, east, etc. One class of our thunderstorms is on the front and advancing edge of a mass of relatively dense air; the density may be due to low temperature, dryness, or high pressure, or all three combined. As the front of this mass pushes southward and eastward, the lighter air in front of it, which may be quiet but is usually moving northward, is lifted up and the thunderstorms form at short intervals all along the line of contact and elevation. This mode of formation brings these thunderstorms usually somewhere in the south and east quadrant of the extensive areas of low pressure, but whether they will move toward the northeast with the rising current of lighter air, or toward the southeast with the lower current of colder air, must depend upon local circumstances, and especially on the relative masses of upper and lower air involved in any given thunderstorm. It was on this basis that thunderstorms were frequently predicted as early as the summer of 1871, and it seems evident that if the path of a storm is directly opposed to the local wind, that must be a very local peculiarity, or possibly only an occasional and exceptional occurrence.

POPULAR WORKS ON METEOROLOGY.

In reply to several inquiries by those who wish to extend their knowledge of meteorology, we take pleasure in publishing the following list for the information of meteorological observers, both regular and voluntary. The literature of meteorology easily accessible to American readers may be described as follows:

A.—The official publications of the Weather Bureau and State Weather Services.

B.—The American Meteorological Journal: A monthly review of meteorology. Edited by Prof. Robert de C. Ward, Harvard University, Cambridge, Mass.

C.—Special text-books on meteorology, of which the following are the principal ones at present available and some of which have been used by the Weather Bureau:

1. A Popular Treatise on the Winds: Comprising the general motions of the atmosphere, monsoons, cyclones, tornadoes, waterspouts, hailstorms, etc. William Ferrel. 8vo. New York, 1889, pp. xii, 408.
2. Elementary Meteorology. William Morris Davis. 8vo. Boston, 1894.
3. Modern Meteorology: An outline of the growth and present condition of some of its phases. Frank Waldo. 8vo. London and New York, 1893.
4. Meteorology: Weather and methods of forecasting. A description of meteorological instruments and river-flood predictions in the United States. Thomas Russell. 8vo. London and New York, 1895.
5. American Weather: A popular exposition of the phenomena of the weather, including chapters on hot and cold waves, blizzards, hailstorms, and tornadoes, etc. A. W. Greely. 8vo. New York, 1888.
6. Meteorology: The elements of weather and climate. H. N. Dickson. 12mo. London, 1893.
7. Meteorology, Practical and applied. John William Moore. 8vo. London, 1894.
8. Weather: A popular exposition of the nature of weather changes from day to day. Ralph Abercromby. 8vo. London, 1887.
9. Elementary Meteorology. Robert H. Scott. Second edition. 8vo. London, 1883, pp. xii, 408.
10. Weather Charts and Storm Warnings. Robert H. Scott. Third edition. London, 1887.
11. Treatise on Meteorology. Elias Loomis. 8vo. New York, 1885.

D.—Text-books on geography or physical geography, many of which have excellent chapters on meteorology, and among which the following may be specified:

1. Complete Geography. Alexander Everett Frye. 8vo. Boston, 1895.
2. Physical Geography. Ralph Stockman Tarr. New York, 1895.
3. Grammar School Geography. Rand & McNally. Chicago and New York. 1895.
4. Eclectic Physical Geography. Russell Hinman. 8vo. Cincinnati and New York, 1888.
5. Appleton's Physical Geography. W. LeConte Stevens. 4to. New York, 1887.
6. Physical Geography. Mathew F. Maury. Royal 8vo. New York and Baltimore, 1873.

METEOROLOGICAL TABLES.

[*Prepared by the Division of Records and Meteorological Data.*]

Table I gives, for about 130 Weather Bureau stations making two observations daily and for about 20 others making only the 8 p. m. observation, the data ordinarily needed for climatological studies, viz, the monthly mean pressure, the monthly means and extremes of temperature, the average conditions as to moisture, cloudiness, movement of the wind, and the departures from normals in the case of pressure, temperature, and precipitation.

Table II gives, for about 2,400 stations occupied by voluntary observers, the extreme maximum and minimum temperatures, the mean temperature deduced from the average of all the daily maxima and minima, or other readings, as indicated by the numeral following the name of the station; the total monthly precipitation, and the total depth in inches of any snow that may have fallen. When the spaces in the snow column are left blank it indicates that no snow has fallen, but when it is possible that there may have been snow of which no record has been made, that fact is indicated by leaders, thus (. . . .).

Table III gives, for about 30 Canadian stations, the mean pressure, mean temperature, total precipitation, prevailing wind, and the respective departures from normal values. Reports from Newfoundland and Bermuda are included in this table for convenience of tabulation.

Table IV gives, for 82 stations, the mean hourly temperatures deduced from thermographs of the well-known pattern manufactured by Richard Bros., Paris, described and figured in the Report of the Chief of the Weather Bureau, 1891–'92, p. 29.

Table V gives, for 67 stations, the mean hourly pressures as automatically registered by barographs of the pattern manufactured by Richard Bros., Paris, except for Washington, D. C., where Foreman's barograph is in use. Both instruments